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Nonlinear Binormal Flow of Vortex Filaments[1] SCOTT STRONG, LINCOLN CARR[2], Colorado School of Mines, Department of Applied Physics —
With the current advances in vortex imaging of Bose-Einstein condensates occurring at the Universities of Arizona, São Paulo and Cambridge, interest in vortex filament dynamics is experiencing a resurgence. Recent simulations, Salman (2013), depict dissipative mechanisms resulting from vortex ring emissions and Kelvin wave generation associated with vortex self-intersections. As the local induction approximation fails to capture reconnection events, it lacks a similar dissipative mechanism. On the other hand, Strong&Carr (2012) showed that the exact representation of the velocity field induced by a curved segment of vortex contains higher-order corrections expressed in powers of curvature. This nonlinear binormal flow can be transformed, Hasimoto (1972), into a fully nonlinear equation of Schrödinger type. Continued transformation, Madelung (1926), reveals that the filament's square curvature obeys a quasilinear scalar conservation law with source term. This implies a broader range of filament dynamics than is possible with the integrable linear binormal flow. In this talk we show the affect higher-order corrections have on filament dynamics and discuss physical scales for which they may be witnessed in future experiments.

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